Rare Reptile Species Richness

These EnviroAtlas national maps display the number of rare reptile species based on potential habitat within each 12-digit hydrologic unit (HUC) in the conterminous United States. These data are based on habitat models, not wildlife counts.

Why are rare reptile species important?

The metric, Rare Reptile Species Richness, estimates the number of rare reptile species that may inhabit an area based on potential habitat. For this map, rare species were considered to be 25% of the reptile species in the U.S. with the smallest amount of predicted habitat.[1] Reptiles are cold-blooded animals with no internal temperature regulation. In cold climates with short summers, reptiles have difficulty not only surviving the winter but completing essential life functions like mating and reproduction.

Species richness is one measure of biodiversity that can represent the relative conservation value of a particular area. Many scientists believe that biodiversity, because it represents all forms of life on earth, provides or supports the core benefits that humans derive from their environment to help sustain human society, economy, health, and well-being. Managing for biodiversity is one way to balance competing demands for ecosystem services.[2] Rarity identifies species that may need focused conservation including habitat protection and management.[3] Rarity and endemism can be used interchangeably to indicate species susceptible to stresses with small geographic ranges.[1]

Reptile species include turtles, snakes, lizards, and alligators—a diverse group of vertebrate species that plays a vital role in ecosystem health. They are an integral part of the food web, acting as both predator and prey species. The removal of even one species from an ecosystem can create a trophic cascade that can affect the entire food chain. Many reptiles feed on pests, such as insects and rodents, which helps to limit damage to plants and cultivated crops. Herbivorous reptiles can be important seed dispersers and pollinators.

Reptile species can be important to human health and the development of pharmaceuticals. For example, substances taken from snakes have been used to develop antimicrobials, anticoagulants, and painkillers, as well as drugs to treat hypertension and high cholesterol.[4] Maintaining the diversity and richness of reptiles allows for the possible future discovery of more valuable treatments.

Photo: Bog Turtle, USFWS

Reptiles are also economically and culturally important. Many people enjoy simply viewing reptiles in their natural habitats. However, reptile numbers have been reduced by development, road kill, habitat loss, predation, and pesticides. The U.S. Fish and Wildlife Service lists 32 terrestrial reptile species (plus 8 sea turtle species) as threatened or endangered in the lower 48 states.

How can I use this information?

Three EnviroAtlas maps Mean, Maximum, and Normalized Index of Biodiversity (NIB), illustrate rare reptile species richness for each 12-digit HUC in the conterminous United States.[5] Used together or independently, these maps can help identify areas of potentially low or high reptile species richness to help inform decisions about resource restoration, use, and conservation. Mean richness is a commonly used and understood value for comparison. NIB provides an index to compare a metric with other metrics across multiple project scales simultaneously. Maximum richness identifies areas that are species rich but may not occupy large areas (e.g. linear riparian areas).

These maps can be used in conjunction with other EnviroAtlas maps such as ecoregions, the U.S. Geological Survey (USGS) protected areas database (PAD-US), or the USGS Gap Analysis Project (GAP) ecological systems to identify areas with high ecological or recreational value for conservation, recreation, or restoration planning. Connectivity planning is also important for reptiles because their life cycles often require traveling between upland and wetland habitats. After learning the rare reptile species richness values for a particular

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12-digit HUC, users can investigate an area more intensively by increasing the transparency to view the aerial imagery beneath. Users can also examine individual species models available from the GAP Project.

How were the data for this map created?

The USGS GAP project maps the distribution of natural vegetation communities and potential habitat for individual terrestrial vertebrate species. These models use environmental variables (e.g., land cover, elevation, and distance to water) to predict habitat for each species. GAP modeled habitat for 322 reptile species that reside, breed, or use the habitat within the conterminous U.S. for a significant portion of their life history. For this map, rare species were considered to be 25% of the reptile species within the conterminous United States with the smallest amount of predicted habitat modeled by GAP.

Predicted habitat for the resulting 81 reptile species was combined to calculate rare reptile species richness by pixel. Of the 81 species, 35 were lizards, 24 were snakes and 22 were turtles. The mean and maximum numbers of reptile species in each 30-meter pixel were calculated for each 12-digit HUC across the U.S. The mean species richness value by HUC was divided by the maximum mean value within all HUCs to calculate the NIB.

What are the limitations of these data?

EnviroAtlas uses the best data available, but there are still limitations associated with these data. The data, based on models and large national geospatial databases, are estimations of reality that may overestimate actual reptile species presence. Modeled data are intended to complement rather than replace monitoring data. Habitat models do not predict the actual occurrence of species, but rather their potential occurrence based on their known associations with certain habitat types. Habitat is only one factor that determines the actual presence of a species. Other factors include habitat quality, predators, prey, competing species, and fine scale habitat features.

Other essential species information in addition to species richness includes the types of species and their functional groups, whether they are rare or common, native or non-native, tolerant or intolerant of disturbance.

How can I access these data?

EnviroAtlas data can be viewed in the interactive map, accessed through web services, or downloaded. Individual 30-meter pixel data may be downloaded from the New Mexico State University Center for Applied Spatial Ecology.

Where can I get more information?

A selection of resources related to reptiles and biodiversity is listed below. Information on the models and data used in the USGS Core Science Analytics, Synthesis & Library's GAP project is available on their website. For additional information on how the data were created, access the metadata for the data layer from the layer list drop down menu. To ask specific questions about this data layer, please contact the EnviroAtlas Team.

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Selected Publications

1. Orme, C.D.L., R.G. Davies, M. Burgess, F. Eigenbrod, N. Pickup, V.A. Olson, A.J. Webster, T.S. Ding, P.C. Rasmussen, and R.S. Ridgely. 2005. Global hotspots of species richness are not congruent with endemism or threat. *Nature* 436: 1016–1019.

2. Boykin, K.G., W.G. Kepner, D.F. Bradford, R.K. Guy, D.A. Kopp, A. Leimer, E. Samson, F. East, A. Neale, and K. Gergely. 2013. A national approach for mapping and quantifying habitat-based biodiversity metrics across multiple spatial scales. *Ecological Indicators* 33:139–147.

3. Gaston, K.J. 1994. Rarity. Volume 13 of the Population and Community Biology Series, Springer Science & Business Media, Berlin, Germany, 205 p.

4. Shaw, C. 2009. Advancing drug discovery with reptile and amphibian venom peptides: Venom-based medicines. *Biochemist* 31(5):34–37.

5. Kepner, W.G., K.G. Boykin, D.F. Bradford, A.C. Neale, A.K. Leimer, and K.J. Gergely. 2013. Biodiversity metrics fact sheet, EPA/600/F-11/006, U.S. Environmental Protection Agency, Washington, D.C.